Demagnetization of cubic Gd-Ba-Cu-O bulk superconductor by cross-fields: measurements and 3D modeling

M. Kapolka¹, J. Srpic², D. Zhou², M. Ainslie², E. Pardo¹, A. Dennis²

1Institute of Electrical Engineering, Slovak Academy of Sciences, Bratislava, Slovakia
2Department of Engineering, University of Cambridge, Cambridge, United Kingdom

Introduction

The effects of finite size and cubic shape of the sample are not well understood

Calculation of cubic bulk demagnetization by cross-field needs 3D modeling

Minimum electromagnetic entropy production method 3D (MEMEP 3D) avoids discretization of air

MEMEP 3D model

Isotropic power law

Comparison with FEM 3D model

The trapped field profile above the sample at different time: calculations

Decrease of trapped field at the center and 100 µm above the sample 0.1 Hz

1st positive peak Bax, time 1002.5s

1st negative peak Bax, time 1002.5s

The trapped field at plane 100 µm above the sample

2nd positive peak Bax, time 1002.5s

1st positive peak Bax, time 1002.5s

1st negative peak Bax, time 1002.5s

Trapped field at plane 100 µm above the sample

10th positive peak Bax, time 1002.5s

FEM qualitatively agree with MEMEP

Measuring and calculation

FEM qualitatively agrees with MEMEP

Both models confirm asymmetry of trapped field.

Comparison with FEM 3D model

The trapped field profile above the sample at different time: calculations

Decrease of trapped field at the center and 100 µm above the sample 0.1 Hz

1st positive peak Bax, time 1002.5s

1st negative peak Bax, time 1002.5s

Trapped field at plane 100 µm above the sample

1st positive peak Bax, time 1002.5s

1st negative peak Bax, time 1002.5s

Trapped field at plane on top of the sample

10th positive peak Bax, time 1002.5s

FEM qualitatively agree with MEMEP

Trapped field at plane on top of the sample

CONCLUSION

Demagnetization shows asymmetry of the trapped field

Screening current decrease below Jc and frequency dependence due to n-factor

MEMEP and FEM method agree well and show the same behavior of demagnetization